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Influence of Energy Prices on the Size of Shadow Economy: A Cross Country Analysis

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We supposed that expenditure growth brought about by an increase of energy price might make it attractive for the firms to hide more taxes and social payments in order to compensate this growth, which could additionally raise the size of shadow economy. To test this hypothesis we, first, used some existing data on the size of the shadow economy for the period of 2000-2003 derived with the help of DYMIMIC model and, secondly, provided our own estimates the share of unofficial sector in GDP using the demand for money method for the period of 2003-2006. Testing both the samples showed a positive correlation between the shadow economy size and the real energy price..

Keywords: shadow economy, institutions, prices, energy intensity, elasticity

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A. Introduction

The project presented adjoins the works devoted to analysis of conditions and factors of development of shadow economy and its role in general system of economic interrelations. As compared to other works on this topic we involve also a factor of prices, namely we take into account influence of energy prices on the size of shadow economy. We suppose that at least under the high energy price increasing corresponding expenditure growth may make it attractive for the firms to hide more taxes and social payments in order to compensate this growth, which could additionally raise the size of shadow economy. This is just the working hypothesis we are testing.

To provide this analysis we firstly constructed regressions for variables of the size of shadow economy existed in the literature and derived with the help of DYMIMIC model for the period of 2000-2003 (Shneider, 2004). These variables showed themselves positively correlated with real energy price in the world economies when a cross country model was applied. At the same time using a panel model did not result in sufficiently reliable estimates: given the actually expected sign of the coefficient of real energy price increment variable in the regression for the size of shadow economy the degree of it's significance was not sufficient. We addressed this fact mainly to a contradictory process of energy price change which by our assumption could block the development of the expected interrelation.

Another feature of the DYMIMIC variables making them inappropriate for our purpose to analyze the relation between the shadow economy and the energy price – is constructing of them with the help of using energy consumption variable as one of the model indicators. By this reason we fulfilled our own estimations of the size shadow economy. We applied three methods which potentially could result in construction of the share of shadow sector in GDP variables. These methods did not presuppose to use any indicators of energy and/or electricity consumption and, so, could be further applied to explain energy intensity variables. Estimations of shadow economy size obtained with the help of these methods showed no correlation either with each other, or with other existing estimations. At the same time they are correlated not sufficiently with either per capita income, or any institutional indices. The demand for money method provided for effective results using a cross country model. We made such estimations involving the samples for 55 to 61 world economies for the period of 2003-2006 when a stable real energy price growth was taking place. The analysis fulfilled further showed that our hypothesis on positive correlation between the energy prices and the size of shadow economy confirmed when using both the cross country and the panel data.

B. Review of literature: emergency sources and role in economy

The total scope of literature on shadow economy could be very conditionally broken into two parts. In the publications from the first group of sources theoretical models were suggested and tested which explained relationship between the size of unofficial economy and a wide scope of different factors. It is well recognized that the most important reason for the rise and the growth of shadow economy is the tax and security contribution burdens (Lippert and Walker, 1997; Shneider, 1994, 2000, 2003, Johnson et. al., 1998a, 1998b; Tanzi, 1999; Giles et. al., 2002). At the same time it is shown that it is not higher tax rates per se that increase the size of the shadow economy but ineffective and discretionary application of the tax system and regulations by governments (Johnson et. al., 1998b). Tax revenues on there own provide for improvement of the governance quality, increase of public goods and, thus, for reduction of the shadow economy extent (Friedman et. al., 2000).

Another reason is strengthening of regulation activities of the government and/or institutional system shortcomings. In the work of Schneider (Schneider, 2000) it was demonstrated that just the increase of tax burden and government regulation explained the growth of the shadow economy income shares in 18 OECD countries over the period 1960 to 1998. Johnson et. al. (1997, 1998b) showed theoretically and empirically interrelation between the degree of regulations and the size of the shadow sector. In the recent years literature the overriding role of corruption was stressed, especially in the developing and transitional economies (Ernste and Schneider, 1998; Johnson et. al., 1998b, 1999; Friedman et. al., 2000; Johnson et. al., 2000; Schneider and Enste, 2000; Dreher et. al., 2005; Dreher and Schneider, 2006). Complementarity of corruption and the shadow economy was suggested (see also Cule and Fulton, 2005). Stricter regulations increase both corruption and the shadow economy; at the same time the shadow economy reduces corruption in high income countries, but increase corruption in low income countries (Dreher and Schneider, 2006, Schneider, 2006).

Among the other reasons of the emergence and growth of the shadow economy a lack of development of public sector services (Johnson et. al., 1998a, 1998b; Friedman et. al., 2000) reducing governance quality and "tax morality/morale reflecting the readiness of agents to enter the shadow economy (Schneider and Klinglmair, 2004). In the works (Torgler and Schneider, 2007a, 2007b) it was analyzed how the individual propensity to pay taxes based on the trust to the government policy affected the size of shadow economy. It was concluded that the higher propensity reduced the shadow sector .Alexeev and Pyle (2003) emphasize that at least in the case of CIS countries "historical roots" of shadow economy should be taken into account.

The shadow economy affects economic growth of the developed, the developing and the transitional economies differently. So, both in the developed and the transitional countries its income share is positively correlated with the economic growth, which could be explained by benefits from the excessive regulation evasion and the strengthening of competition. In the developing countries such a correlation is negative: less tax revenues means the reduction of both regulation quality and public goods supply (Schneider and Klinglmair, 2004). In the article of Polterovich (1993) influence of the shadow economy (black markets) on the incomes distribution during transition was analyzed.

The publications from the second group of sources are devoted to measuring of the shadow economy size. There are three groups of methods of its estimation being applied by the scholars and the experts: direct measuring methods, indirect methods and an approach based on application of a modeling multiple courses and multiple indicators of the shadow economy. **Direct approaches** are based on direct replies or selected microeconomic tax and incomes audits. The group of **indirect methods** includes analysis of detected discrepancies between certain economic indicators: incomes and expenditures, actual and official labor force, either money transactions, or demand for money and other macroeconomic indicators, electricity consumption and aggregate income (1994, 1996; Tanzi, 1982; 1984; Giles, 1999a, Lacko, 1996, 2000). The authors themselves mention that all the methods referred have their own advantages and disadvantages, the latter being associated mainly with concentration on any separate type of the shadow activities.

Schneider and Klinglmair (2004) argue that an approach, which we indicated as the third one, based on an the **application of a model including a shadow economy variable as being latent** and indirectly estimated one provides for taking into account all the main factors affecting the development of the unofficial economy. Both the approach and the model are referred to as MIMIC (DYMIMIC: dynamic multiple-indicators multiple-causes) approach and model. This approach was initially used for a cross country OECD analysis (Weck, 1983). Further it was rather broadly applied by other authors (Giles and Tedds, 2002; Bajada and Schneider, 2003; Schneider, 2004). Its comprehensive critical analysis was undertaken by Breusch (2005), who came to a conclusion that this method is unfit for the purpose of measuring the share of the shadow economy due to its dependence on the units selected to measure the indicators used. Nevertheless, DYMIMIC approach stays to be popular at present time.

Estimations for Russian regions were provided by Nikolayenko et. al. (1997), Martynov et. al. (1997) and by Komarova (2003). In the first work tree measuring methods using incomes, unemployment and tax revenues were applied. In the second work in order to calculate the size of shadow economy in Russian regions a group of indicators (consumption of electricity and fuel consumption, transport load statistics, environmental pollution and some others) was compared to legal production and official individual income levels. In the work of Komarova electricity consumption methodology was applied. The results obtained by the authors referred were analyzed both themselves and by other scholars (Popov, 2001). It was found out that the size of shadow economy was higher in the regions situated close to the border and negatively correlated with the level of crime. Political stability suppressed shadow activities; growth of living standard was negatively correlated with shadow economy size. On the other hand official incomes grew faster in the regions with higher shadow economy size.

We didn't find in the literature on shadow economy any discussions of the questions of production factor prices and/or cost influence on the size of shadow economy. Nor other questions of our concern are treated in publications e.g. those associated with structure differences and structure change or the role of shadow economy as an alternative for conservation of production resources. In the present work an attempt is made to meet this lack.

C. Methodology.

***a)* Theoretical notes.** Our work is strongly empirical and devoted to construction of shadow economy variables by world countries and to regression analysis of their reaction to various factors including the real energy price. However we can't avoid completely a theoretical discussion which could be useful for justification of our working hypothesis on positive and significant relation between the size of shadow economy and the growth of real energy price.

In performing the analysis of the formed variables we use the theoretical model developed in (Friedman et. al., 2000). The representative firm when it decides how much of income will be "withdrawn" to shadow, solves the following problem:

$$\underset{Y2}{Max}[(1-t-r)\cdot(Y-Y_2)\cdot R(T)+Y_2-(k\cdot(Y_2)^2/2)] \qquad (1)$$

where Y is the total firm's income, Y_2 – its shadow income, t is the tax rate, r – the parameter of bureaucratic costs caused by excessive regulation, k – the parameter of effectiveness of the legal system, $R(T)$ – the payoff of funds invested legitimately, T – the total tax revenue and $dR/dT>0$. Therefore, in this model it is postulated that all legal net income of the firm is invested and the payoff of these investments is the higher, the higher tax collection is and, therefore, the higher the supply of public goods and the better the quality of regulation. At the same time, the agents have a motive to conceal their activity, and this motive is the stronger, the higher taxation, bureaucratic costs and the lower the controls are. The only thing we are adding to this model is the parameter R dependence on real average cost: $R= R(T, ACOST)$, so that $\partial R/\partial T>0$ and $\partial R/(\partial COST)<0$. The optimal amount of shadow income is

$$Y_2=(1/k)\cdot(1-(1-t-)\cdot R(T, ACOST), \text{ if } Y_2<Y, \text{ and} \quad (2a)$$

$$Y_2=Y \text{ otherwise.} \quad (2b)$$

Therefore, according to the solution of the problem the rise in the prices of resources raising expenditure *ACOST* can cause, at least temporarily, a tendency to growth of the shadow economy. Theoretically a price structure change should immediately cause production factor structure adjustment with a reduction of the shares of those of them which became respectively more expensive, i.e. in our case – energy. At the same time if the production function has a property of constant returns to scale, average real cost comes back to initial level.

Therefore, from the theoretical point of view influence of the energy price growth on the size of shadow economy can not be too important. However, there is an obstacles which sharpen the problem because may defeat the recovering of the system. There are serious empirical evidences based on the experiences of 1970-80ths years which got fundamental theoretical foundations that the effect of energy intensity of production reduction following the increase of energy prices occurs immediately only in its part and takes place mainly within the long run period. So, J. Sweeney summarizing the experiences of 1970ths – beginning of 1980ths stressed that reaction of economy to the energy price change included processes of substitution for energy with other factors, substitution for some energy factors with other energy factors, change from production of some final goods to other final goods, change of production structure and combination of these processes (Sweeney, 1984). The differences between short run and long run demand price elasticities are principal. The short run one expresses change of energy intensity under minimal change of proportions of production factors in a use. The long run elasticity on the contrary reflects essential change of the total bundle of the production factors used including the fixed capital. Since energy consumption equipment generally requests sticky demand for the amount of energy consumed, the complete reaction of the system to energy price growth takes place only after the complete replacement of this equipment by the new one. However the fixed capital often has long exploitation terms and its complete replacement demands foe many years. By this reason the long run reaction of the system to price relation change is much higher than the short run one. The short run system respond takes place within the period up to 10 years and the long run one – not less (and probably essentially higher) than 10 years and is associated with the capacities of the economy to produce new equipment, investment process intensity, technological progress and the economic growth rates (Sweeney, 1984, Kouris, 1983). Convincing evidences to the fact that the energy intensity reduction as a respond to the growth of energy price requires just the long time period to be realized were presented by many authors who compared the long run and the short run demand for energy price elasticities in different countries (Kouris 1981; Welsch, 1989; Beenstock and Dalziel, 1986; Hunt et. al., 2003). So, according to Beenstock and Dalziel (1986) the short run and the long run price elasticity values in Great Britain differed from each other by 1.6 times in general and for industrial sector – for more than 2.6 times. Similar and even more vivid differences were mentioned by other scholars for other economies.

Except for time limitations associated with technological change there are also other factors hindering a quick firms' adjustment to change of the prices even if proper measures are technically feasible to be made rapidly enough. We wean liquidity constraints which could first of all be the problem of small enterprises especially in the economies with not sufficiently developed financial systems, e.g. in the former socialist countries.

b) Illustration of hypothesis validity: analysis of available data. In order to provide a preliminary testing of the hypothesis made, we have used the published data on the size of the shadow economy obtained as a result of DYMIMIC (dynamic multiple-indicators multiple-causes model - Schneider and Klinglmair, 2004; Schneider, 2004) application realizing that these evaluations are not entirely adequate for our purposes because one of the model indicators is the relative level of energy consumption. At the same time analysis of these data confirmed our assumption on the positive correlation between the real energy price and the size of the shadow economy

First mention that the considered variables of the size of the shadow economy are significant in regressions explaining differences in the world economy in energy intensity levels derived as a ratio of the total energy consumed in production sphere of the economy to GDP PPP (Table 1). These regressions are similar to the regressions substantiated and constructed in (Suslov and Ageeva, 2005). Along with temperature regressors (*MEATE*) and the relative price, energies P/p_e they include the shadow economy size variable substituting for the institutional variable that enters specifications discussed in the mentioned work. Here the meaning of the size of the shadow economy as a regressor seems to be that it starts to play a dual role: both as the institutional and structural variable. First, it weighs the quality of institutions in countries and thus explains differences in energy consumption efficiency. In its second role, this variable reveals that the energy consumption observed is overestimated in comparison with its actual level because official statistics more completely reflects energy costs in the shadow sector as compared to the income earned in it. The variable of the logarithm of the share of the shadow economy in GDP is significant, which indicates good reliability of the used data on the unofficial sector size. Note also that the real price of energy in these regressions can show endogeneity because the energy consumption level can affect the level of this price. Therefore it is required to use a two-stage estimation method with introducing the instrumental variable for the real energy price. However, we failed to find such variables. Data for the single, in our opinion, "candidate" for this role, notably the level of oil import prices, are available only for 23 countries that are all the OECD members (database statistics of the International Energy Agency). Unfortunately, these data are insufficient for our purposes.

Table 1.

Production sphere energy consumption in world countries estimated using the shadow economy size variable based on DYMIMIC (*OLS**, Dependent variable *Ln(Energy consumption in the production sphere/GDP)*, the covariance matrix estimated by the White method)

	2000, 70 observations	2002, 73 observations	2003, 75 observations
Constant	-.9530, t-Value=-2.84	.8988, t-Value=4.29	.8671, t-Value=4.73
Mean annual temperature: *MEATE*	-.0029, t-Value=-5.24	-.0020, t-Value=-3.38	-.0021, t-Value=-3.75
Real energy price: $Ln(P/p_e)$	.2728, t-Value=2.52	.4082, t-Value=4.74	.3921, t-Value=6.39
Ln(Shadow economy share in GDP)	.3932, t-Value=3.25	. .3926, t-Value=3.74	.3754, t-Value=3.91
R-squared	0.2927	0.3390	0.3451
F-Value	12.70	15.31	22.25
Root MSE	.40273	.41858	.41837

* No data to form the instrumental variable for the energy price.

It turned out to be possible to estimate the variables of the size of shadow economy using the regressor of real energy price in the cross country model (Table 2). For each of the years considered, for which data on the size of the shadow economy obtained with the use of the DYMIMIC method are available, we used the same specification, which besides the variable of the real energy price included one of the World Bank indices of the institutional strength, namely regulatory quality. The latter is significant and enters regressions with a negative sign, which is a natural factor and indicates sufficient reliability of the indices used. The variable of the ratio of the average price, i.e. the ratio between the purchasing power parity to the exchange rate of the national currency, to the average price of energy carriers also enters the specification with a negative sign and is also significant. This means that in those countries where the energy price is higher in purchasing power parity terms, all other conditions being equal, the size of the shadow economy is higher too, which is exactly the core of our working hypothesis.

The panel estimation of the growth rates of the shadow economy size on increments of other indices is not very convincing (Table 3). Thus, the fact that, as the regression indicates, per capita income growth has resulted in an increase in shadow economy share in GDP can cast doubts. The significance level of the variable of relative values also does not seem sufficient, though the variable mentioned enters the regression with a "correct" sign.

Table 2.

Size of the shadow economy* in world countries estimated based on DYMIMIC, with the use of the variable of the real energy price (Dependent variable *Ln(Shadow economy share in GDP)*, covariance matrix estimated by the White method)

	2000, 70 observations	2002, 73 observations	2003, 75 observations
Constant	3.1578, t-Value=25.11	-1.223, t-Value=-16.86	-1.1927, t-Value=-21.82
Real energy price: $ln(P/p_e)$	-.3594 t-Value=2.72	-.1698, t-Value=-2.48	-.1786, t-Value==2.95
Regulatory quality index: *RQ*	-.2692, t-Value=-4.96	-.3627, t-Value=-8.74	-.3786, t-Value=-10.01
R-squared	0.4592	0.5267	0.5605
F-Value	30.96	40.17	50.94
Root MSE	.38845	.36306	.36097

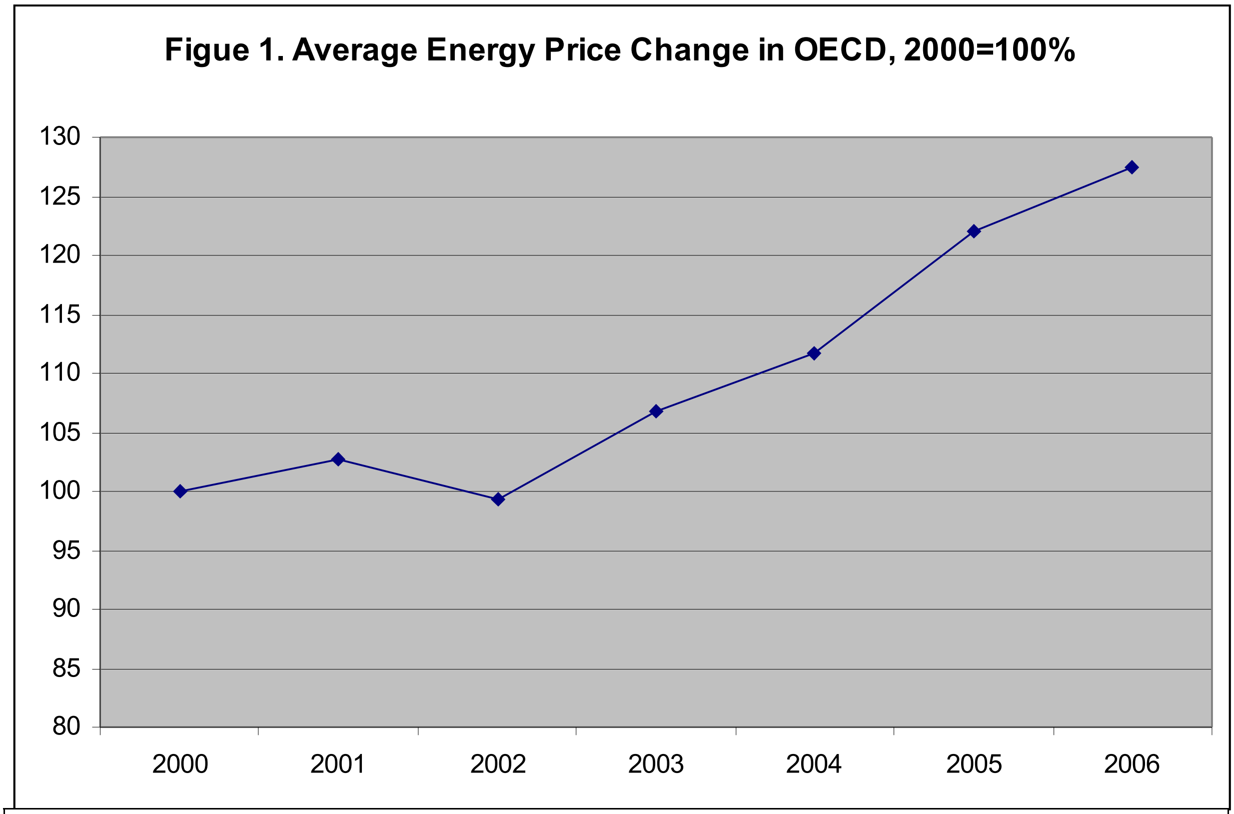
*Variables calculated using DYMIMIC (Schneider, 2004)

Table 3

Evaluation results for the growth of the shadow economy share in GDP $\Delta ln(sm)$ during 2001-2003 in world countries (panel data obtained based on DYMIMIC, the model with random effects, 209 observations, 71 group)

	Coefficient	z-Value	P>|z|
Constant	.0069	2.65	0.008
Growth P/p_E	-.0057	-1.89	0.059
Growth *ln(GDP per capita)*	.9265	3.26	0.001
Inflation level	.0004	2.14	0.032
Within R-sq	0.0500		
Between R-sq	0.0974		
Overall R-sq	0.0895		
Wald chi2(4)	14.41		
sigma_u	.01604		
sigma_e	.01240		
Rho	.6259		

Not high quality of the panel regression can be mainly explained, in our opinion, by that energy prices were not stable enough in the period of 2000-2003. For example, according to International Energy Agency (IEA) data, in OECD countries the average energy price level increased in 2001 and 2003 and decreased in 2002, which might have blurred the influence of the price factor on variables of the shadow economy size. This determined our choice of the 2003-2006 period as most favorable for sound estimation.



Data source: International Energy Agency, http://data.iea.org

Another fact that discredits these results is that in the construction of variables of the shadow economy based on the DYMIMIC method the energy consumption variable is used. In this case, the use of energy prices to explain dynamics of the shadow economy size and its differences among countries becomes unacceptable because of systematic errors in statistical evaluation.

Below we present results of the analysis based on statistical data without energy consumption variables for the period with steady rise of prices of energy carriers.

c) Samples and variables. We use a sample of countries the number of which is defined by availability of statistical data on energy prices, institutional strength indices and estimations of the shadow economy income shares. To compare our estimates of the shadow economy with other existing estimates we used already published data on shadow economy share in GDP. Their source is a sample from (Schneider, 2004) containing estimates for 145 countries of the world prepared with the help of DYMIMIC model for the period 1999-2003. Since these data were constructed with the help of energy (electricity) demand indicators, strictly speaking, they are not appropriate for our purpose.

We base our statistical analysis on regression of specific demand for energy from the production sphere of the economy. To create these regressions the following variables and data sources were used (Suslov and Ageeva, 1995):

Y - ВВП по ППС - World Development Indicators 2002 CD-ROM .

E - energy consumption in production sphere - IEA data: http://data.iea.org**.** This variable is calculated as the total energy supply in the country subtracting consumption of households and non-energy use.

e - energy intensity of production, calculated as *E* /*Y.*

MEATE – average annual temperature for the same period and from the same source1990 - data from: http://ddcweb1.cru.uea.ac.uk.

Institutional strength indices - Research project "Governance Matters VII: Governance Indicators for 1996-2007". (http://www.worldbank.org/wbi/governance/). The total sample consists of the following indices (Kaufmann et. al., 2008):

VA (Voice and Accountability) - measures the extent to which citizens of a country are able to participate in the selection of governments.

PS (Political Instability and Violence) - measures perceptions of the likelihood that the government in power will be destabilized or overthrown by unconstitutional means.

GE (Government Effectiveness) - measures quality of bureaucracy and credibility of the government's commitment.

RQ (Regulatory Quality) - measures incidence of market unfriendly policies including price controls and inadequate bank supervision.

RL (Rule of Law) - measures the extent to which agents have confidence in and abide by the rules of society.

CC (Control of Corruption) - measures perceptions of corruption.

p_E - end use energy price for industry - data from IEA: http://data.iea.org and from EBRD (Transition Report, 2006).

P - average output price calculated as a relation of nominal GDP in US$ to PPP GDP.

M0/M2 – share of cash money in monetary aggregate «Money plus Quasi-Money (M2)» IMF hard copy issue «International Financial Statistics Yearbook, 2006»,

R – deposit interesting rate, World Development Indicators 2008 CD-ROM,

Tr – share of taxes of Central Government on GDP (tax burden), World Development Indicators 2008 CD-ROM,

Sr – share of subsidies and other transfers in GDP[1], World Development Indicators 2008 CD-ROM,

[1] In WDI database the following definition for subsidies indicator: «Subsidies, grants, and other social benefits include all unrequited, nonrepayable transfers on current account to private and public enterprises; grants to foreign governments, international organizations, and other government units; and social security, social assistance benefits, and employer social benefits in cash and in kind» (World Development Indicators 2008 CD-ROM).

As *instrumental variables* for institutional strength indices we use infant mortality rates for corresponding years. (World Development Indicators 2008 CD-ROM).

The variables of the size of shadow sector we derived we indicated as *sm03, sm04, sm05, sm06* correspondingly for the years of 2003, 2004, 2005, 2006. Alternative data on the sise of shadow sector, estimated using the DYMIMIC model we further indicate as *ss00, ss02, ss03* for the years of 2000, 2002 и 2003 (the data for 2001 were not provided).

D. Estimation of the size of shadow economy by the world economies using the variables of cash money

In this section we are discussing both the demand for money method to estimate the size of shadow economy, and the results of its application for the samples of 48 to 66 economies and for the time period of 2003-2006. We are starting the discussion from the description of the classical demand for money method used before by the other authors for the time data series. Further we are modifying it to adjust it better to the cross country analysis and contemporary phenomena.

The classical demand for money method is based on an assumption that shadow transactions are undertaken in the form of cash payments, so as to leave no observable traces for the authorities. A strengthening of tax and/or regulation pressure raises shadow economy size and, thus, the ratio of cash holdings to current and deposit accounts. We propose here a model following Tanzi (1983, see also Schneider and Klinglmair, 2004):

$$ln\ (M0/M2)_t = \gamma_O + \gamma_1 \cdot ln\ (1+TW)_t + \gamma_2 \cdot ln\ (WS/Y)_t + \gamma_3 \cdot ln\ (R_t) + \gamma_4 \cdot ln\ (y_t) + u_t \qquad (3)$$

with $\gamma_1 > 0$, $\gamma_2 > 0$, $\gamma_3 < 0$, $\gamma_4 > 0$,

M0/M2 - the ratio of cash holdings to current and deposit accounts, *TW* - a weighted average tax rate (to proxy changes in the size of the shadow economy),

WS/Y - a proportion of wages and salaries in national income (to capture changing payment and money holding patterns),

R_t - the interest paid on savings deposits (to capture the opportunity cost of holding cash),

y_t - the per capita income.

The model (3) attributes all the changes in the shadow economy size to the changes of the second term in its right side. This means that measuring procedure includes calculating *M0* to *M2* ratio given the lowest (minimum) tax burden and comparing it to its actual level. Further the share of shadow economy can be computed given the assumption of a constant money velocity both in official and unofficial sectors of economy.

Since the classical demand for money method to estimate the size of shadow economy as it was suggested nut applied by us for the cross country data did not result in workable estimations (see below) we modified it. We used as a dependent variable the cash currency to nominal GDP ratio and specified its dependence on the tax rate as more complex with respect to the (3). Besides of this to our final specification does not fall the level of per capita GDP and *WS* to *Y* ratio since they did not demonstrate sufficient significance in our regressions for the years of the period 2000-2004. As a subsidiary variable we used also one of the indices of institutional strength. .

The classical demand for money method to estimate the size of shadow economy in our work as it was suggested initially but applied by us to the cross country data did not result in any workable estimations. For this reason we modified it. First, to specification which was finally chosen did not enter the variable *WS/Y*, since it did not demonstrate any sufficient level of significance in our regressions. A probable reason for this fact might be essential reduction of the degree of monetization of payments to compensate labor due to the spread of new payment technologies which did not require using cash money. Secondly, as one of regessors to explain the M0 to M2 ratio we used a share of subsidies and other transfers in GDP which demonstrated a stable and high significance in the regressions for the period considered. An explanation for this phenomenon may be an assumption that the degree of monetization of subsidies in the sense of their transfer into cash money is high.

Modified demand for money method. For the model of cross country data we have used the following specification:

$$ln\ (M0/M2) = \gamma_O + \gamma_1\ ln\ (1+ Tr)\cdot RL + \gamma_2 \cdot Sr + \gamma_3 \cdot ln\ (R) + \gamma_4 \cdot ln\ (y) + u \qquad (4)$$

that instead of the variable of labor compensation share in GDP includes the share of subsidies and other transfers in GDP *Sr*. As we have already mentioned, the first variable lost its explanatory force due to the development of new payment technologies; the second variable turns out to be significant because, as could be expected, subsidies and other transfers have high level of monetization.

Table 4.

Estimation of the cash share (M0) in the M2 aggregate in world countries (dependent variable *Ln(M0/M2),* specification (4) covariance matrix estimated by the White method)

	2003, 66 observations	2004, 65 observations	2005, 60 observations	2006, 48 observations
Constant	-1.6838, t-Value=-7.84	-1.8675, t-Value=-11.46	-1.8135, t-Value=-11.11	-1.4790, t-Value=-5.65
Interactive term: *Ln(1+Tr)*RL*	-1.35334, t-Value=-2.23	-1.6031, t-Value=-2.86	-1.7409, t-Value=-3.98	-1.6274, t-Value=-2.51
Share of subsidies in GDP	4.3305, t-Value=4.43	4.5747, t-Value=4.95	3.677, t-Value=5.03	2.8528, t-Value=2.90
Ln(Deposit interest rate)	-.2581, t-Value=-3.14	-.2020, t-Value=-2,93	-.2064, t-Value=-3.02	-.2294, t-Value=-2.14
Ln(GDP per capita)	-.4665, t-Value=-4.80	-.4034, t-Value=-4.92	-.3400, t-Value=-5.11	-.4021, t-Value=-3.40
R-squared	0.5594	0.5961	0.6581	0.6841
F-Value	28.29	29.30	40.94	26.53
Root MSE	.54562	.50244	.43977	.49331

Another distinction consists in that instead of the tax burden variable *ln(1+Tr)* the interactive term *ln(1+Tr)·RL* is used as the product of the tax burden variable *ln(1+Tr)* and one of the institution quality indices, namely the Rule of Law *RL*. The introduction of this variable into the regression corresponds to the representation that the growth of tax level differently affects the sizes of the shadow economy in countries with good and bad institutions. In countries with good institutions, the growth of tax share in GDP means an increase in tax revenues, and hence, offers of public benefits and improvement of the regulatory quality, which reduces the sizes of the shadow economy. For countries with bad institutions the growth of tax share in GDP means an increase in the tax burden, and hence, expansion of the shadow economy.

In our opinion, the estimation results (Table 4) are fairly convincing. The application of developed models to estimate the sizes of the shadow economy is based on the benchmark formation and a comparison of the subjects under study with it. Here we have chosen the USA economy as a benchmark because this country has one of the best statistical systems. The estimation procedure is as follows. Ratios of cash (M0) and M2 aggregate volumes are calculated reasoning from the econometric model parameters that would be if general economic conditions common to the USA were implemented in it, but with variables responsible for the shadow economy inherent to the given country. This means that for each country the variables that are assumed to be not related to the shadow economy are taken at the level of economy-benchmark (USA), whereas the variables reflecting the sizes of the shadow economy are taken at the actual level. A comparison of such a calculation with the USA level yields the correlation between the sizes of the shadow economy in the given country and the benchmark country. The only one thing left is to find the average size of the shadow sector in the sample as a whole. We perform this only for the year preceding the basic 2003, having taken the average shadow economy share of income in this year at a level of 33.4%, as determined by Frederic Schneider based on the DYMIMIC model (Schneider, 2004). Dynamics of the shadow economy size in succeeding years is obtained reasoning from its permanent level in the USA: Despite that the real energy price in the USA increased during the period under review, which might have caused the growth of the shadow sector share in USA GDP, we performed calculations on the assumption of its constant share. Thus, the results obtained meet the condition of the minimum possible estimation of the growth of the shadow sector share in GDP during the period under review. Nevertheless, even these data indicate the growth of the shadow economy size in the time period considered (Table 5). Some reduction of the average level of the shadow economy share in 2006, as compared to 2005, is explained by a difference in samples: in 2006 the sample was by 11 countries less, mainly because of exclusion from it economies with the shadow economy size higher than the average level.

Table 5

Variables of shadow economy shares in GDP*: summary statistics [2]

. summarize *sm03 sm04 sm05 sm06*

Variable	Obs	Mean	Std. Dev.	Min	Max
sm03	84	.2949467	.0697882	.160474	.480375
sm04	83	.2981553	.0798325	.138833	.451867
sm05	84	.3168048	.0933921	.131651	.494164
sm06	73	.3148012	.0935924	.139914	.509000
ss00	108	.3319722	.1419061	.086	.673
ss02	108	.3404444	.1444899	.087	.681
ss03	108	.3474907	.1477997	.084	.683

* *sm03, sm04, sm05, sm06* –shadow economy share in GDP in 2003, 2004, 2005, and 2006 respectively as a result of using the modified money demand method (equation (4), Table 4). *ss00*, *ss02*, *ss03* –shadow economy share in GDP in 2000, 2002, and 2003 as a result of using DYMIMIC (Schneider, 2004).

Table 6

Average values of the shadow economy size in the groups of countries in %

	2003		2004	2005	2006
	*sm**	*ss***	*sm**	*sm**	*sm**
Sample as a whole	29.5	34.7	29.8	31.7	31.5
Former socialist economies	32.7	38.3	32.6	35.3	36.3
CIS countries	36.8	50.5	39.7	41.7	42.9
Eastern European and Baltic Countries	27.2	32.7	30.3	31.4	31.5
OECD economies	21.1	18.3	20.1	20.5	21.2

* result of using the modified money demand method (equation (4), Table 4)
** result of using DYMIMIC (Schneider, 2004)

Unlike the data calculated based on the DYMIMIC method, our estimations are much less scattered relative to the deviation from the mean of group average values of the shadow economy share in GDP for separate countries. A possible reason for this seems to be the use of only one

[2] Data on the shadow economy share in GDP for separate countries are given in Table A1-A2 in Appendix.

indicator (money demand), while the alternative approach discussed is based on several criteria. One more comment that concerns the data given in Appendix, Table A2: high level of the shadow economy in the USA (at a level of 25.7%) that we obtained is likely to be the consequence of using dollars in cash to perform shadow operations beyond the USA. So, part of the shadow economy that we have assigned to the given country shall be considered as foreign for the USA but supported with American dollars.

Table 7.

Production sphere energy consumption in world countries estimated using the variable of the shadow economy size (*OLS**, Dependent variable *Ln(Energy consumption in the production sphere/GDP)*, covariance matrix estimated by the White method)

	2003, 61 observations	2004, 58 observations	2005, 61 observations	2006, 55 observations
Constant	1.3921, t-Value=3.50	1.2341, t-Value=3.96	1.3281, t-Value=3.55	1.2012, t-Value=6.14
Mean annual temperature	-.0017, t-Value=-2.22	-.0017, t-Value=-2.44	-.0021, t-Value=-2.99	-.0020, t-Value=-2.36
Actual energy price: $Ln(P/p_e)$	.3825, t-Value=5.21	.4080, t-Value=5.38	.2312, t-Value=2.46	.2940, t-Value=1.89
Ln(Share of shadow economy in GDP)	.8423, t-Value=3.47	.7259, t-Value=4.05	.9290, t-Value=2.91	.7670, t-Value=5.91
R-squared	0.3143	0.3528	0.2122	0.4485
F-Value	11.33	12.16	8.87	19.16
Root MSE	.40345	.36273	.64413	.33637

* No data to form the instrumental variable for the energy price.

Our estimations of the shadow economy size are effective in explanations of differences in production sphere energy consumption in the world countries. These regressions are similar to the regressions substantiated and constructed in (Suslov, Ageeva, 2005) and are the same as those that we used to test the variables of the shadow economy size for the beginning of the 2000's (see Table 1) obtained by Schneider (Schneider, 2004). Along with the temperature regressors (*MEATE*) and the relative energy price P/p_e, they include the variable of the shadow economy size. As noted above, the meaning of the shadow economy size as a regressor consists in that it plays the dual role: both as the institutional and structural variable. First, it weighs the quality of institutions in the countries and thus explains differences in energy consumption efficiency. In its second role, this variable reveals that the energy consumption observed is overestimated in comparison with its actual level because official statistics more completely reflects energy costs in the shadow sector as compared to the income earned in it. The variable of the logarithm of the share of the shadow economy in GDP is significant, which indicates good reliability of the used data on the unofficial sector size.

Both systems of estimations (Table 1 and Table 7) have a common year (2003), which allows a comparison of the effect of two estimates of the shadow economy: one obtained using the DYMIMIC model (Table 1, column 4) and our variables constructed based on the analysis of money demand (Table 7, column 2). As expected, elasticity of the influence of the shadow economy size on the observed indicator of energy consumption is higher when our estimations are used than in the case of DYMIMIC estimations: approximately 0.77 against approximately 0.39, i.e. twice. It is natural to attribute the difference to distinctions between the real and observed changes in energy consumption, at least partially. The point is that the first method involves a comparison of energy use and the GDP, i.e. in fact the analysis of energy consumption, as one of the indicators of changes in sizes of shadow economy. Hence, it may take real changes in energy consumption for changes in the size of shadow economy overestimating the amplitude of its fluctuations.

E. Analysis of factors affecting shadow economy sizes

We have developed models that explain, firstly, the effect of real energy price levels on the sizes (shares of GDP) of the shadow economy (Table 8-9), and secondly, their changes causing changes in sizes of the unofficial sector (Table 10). For cross country data we used almost the same model as in the analysis of shadow economy variables based on the DYMIMIC approach. The only difference here is that the energy price enters in the exponential form (i.e., the logarithm of this regressor is not taken for the logarithm of the shadow economy size in the specification), which does not change the direction of the effect of the real energy price: as expected, it positively correlates with the dependent variable assessed. Another regressor, the regulatory quality index, is the same as in the previous model. Its effect on the shadow economy size is negative: the better economic policy, the lower is the level of the shadow sector, other conditions being equal. Unfortunately, other possible regressors such as per capita income, inflation, interest rate did not demonstrate high working capacity in our regressions. In order to smooth the problem of heteroscedasticity for all cross country models, we have applied the White method to estimate the covariance matrix.

Since the level of the shadow economy can also affect the institutional environment, including the regulatory quality, then along with the ordinary least squares method we employed the model of two-stage estimation with instrumental variables. We have chosen the child mortality index as a variable used to instrument the regulatory quality factor (see Suslov and Ageeva, 2005). We assume that the child mortality level is directly associated with the institutional environment quality and only indirectly with the shadow economy. As seen from the comparison of data in Tables 8 and 9, both models used produce almost similar results: both factors are permanently significant and have the expected signs. Thus, we draw a conclusion that in those countries where the level of the real energy price is higher, the level of shadow economy was higher, under otherwise equal conditions. This can be explained by attempts of the firms to compensate for higher costs by additional savings on tax and social payments, which determines their higher degree of income concealment.

Table 8.

Estimation of size of the shadow economy in world economies using the variable of the real energy price (Dependent variable *Ln(Shadow economy share in GDP)*, covariance matrix estimated by the White method)

	2003, 61 observations	2004, 58 observations	2005, 61 observations	2006, 55 observations
Constant	-1.1131, t-Value=-60.94	-1.0460, t-Value=-44.61	-1.0061, t-Value=-39.80	-.90902, t-Value=-18.35
Real energy price: P/p_e	-.0208, t-Value=-3.89	-.0356, t-Value=-3.51	-.0211, t-Value==2.86	-.1508, t-Value==2.03
Regulatory quality index: *RQ*	-.2555, t-Value=-14.40	-.3204, t-Value=-14.16	-.3503, t-Value=-12.47	-.3497, t-Value=-14.65
R-squared	0.8028	0.8137	0.7755	0.8339
F-Value	165.61	151.35	109.58	107.27
Root MSE	.11973	.13629	.16282	.13918

Table 9.

Estimation of size of the shadow economy in world economies using the variable of the real energy price based on the *IVLS** method (Dependent variable *Ln(Shadow economy share in GDP)*, covariance matrix estimated by the White method)

	2003, 60 observations	2004, 57 observations	2005, 61 observations	2006, 55 observations
Constant	-1.1148, t-Value=-64.68	-1.04926, t-Value=-40.06	-.9903, t-Value=-32.69	-.91173, t-Value=-16.40
Real energy price: P/p_e	-.0208, t-Value=-3.82	-.0359, t-Value=-3.41	.0245, t-Value==-3.14	-.1515, t-Value==2.03
Regulatory quality index: RQ^*	-.2542, t-Value=-13.21	-.3179, t-Value=-11.73	-.3708 t-Value=-10.76	-.3449, t-Value=-9.25
R-squared	0.8017	0.8137	0.7729	0.8338
F-Value	126.24	91.85	89.30	42.92
Root MSE	.1206	.13699	.16375	.13925
Hausman test, chi2(2), In parentheses: Prob>chi2	0.06 (0.9708)	0.10 (0.9533)	1.04 (0.5943)	

* Regulatory quality variable *RQ* is instrumented using the variable of child mortality

In order to check the actual relation between changes in energy prices, on the one hand, and changes in the shadow economy size, on the other hand, we have developed a panel model for the period of stable price increase from 2004 to 2006, with 2003 taken as the basic year (Table 10). To exclude the distorting effect of temporary trends, we started to operate with gains of indices and activated the model with random effects. The results turned out to be more informative than in panel estimates. Thus, our hypothesis that the growth of relative energy prices has resulted in an increase in the shadow economy size is proved because we simultaneously control other factors that are likely to affect the shadow economy. So we introduce the change in the interactive term $ln(Tr)\cdot RQ$, which is the product of tax burden (*Tr* is the share of tax revenues of the central government in GDP) and the regulatory quality index *RQ*, into the regression with the negative sign. This means that the growth of tax burden has led to an increase in the shadow economy size when the regulatory quality worsened, but the growth of tax revenues decreased the shadow economy size if at the same time the quality of economic policy was improved. This is well consistent with our representations established already at the stage of estimating the shadow economy size (the effect of the variable *ln(Tr)·RL* see in Table 4 and specification (4)). The inflation level has also shown itself as a significant factor: more intense growth of the average level of prices corresponded to higher growth of the shadow economy size.

Table 10

Estimation results of the growth of the shadow economy share in GDP ***Δln(sm)*** in world economies over the period of 2004-2006 (panel data, model with random effects, 160 observations, 62 groups)

	Coefficient	z-Value	P>|z|
Constant	-.0117	-2.06	0.039
Increment of *ln*(*P/p*$_E$)	-.0573	-2.54	0.011
Increment of the interactive term *ln(Tr)*RQ*	-.4737	-2.87	0.004
Variation of the Rule of Law index *RL*	-.2005	-4.96	0.000
Inflation level	.5696	6.07	0.000
Within R-sq	0.1899		
Between R-sq	0.5440		
Overall R-sq	0.3895		
Wald chi2(4)	95.51		
sigma_u	.00711		
sigma_e	.04132		
Rho	.02875		

These results both in the meaning of the specification used and in the meaning of statistical tests performed seem to be fair. It is possible to conclude that over the period of 2004 to 2006, when a stable and rather intense increase in the relative energy prices took place in the world economies (see the plot in Fig. 1), this was an independent factor of the growth of the shadow economy size, which confirms our working hypothesis.

F. Conclusion

Within the implementation of this project based on the analysis of the money demand method we developed the indices of the shadow economy size for samples of 55 to 61 world economies (depending on the particular year) for the period of 2003-2006. Since the evaluations by the classical scheme proposed by Tanzi (Tanzi, 1983, see also Schneider and Klinglmair, 2004) did not produce significant results, we modified the model to estimate the shadow economy by this method. We took into account the effect of the quality of institutions and replaced the variable of the labor compensation share in GDP by the variable of the share of subsidies and other transfers of GDP that, in our opinion, have high level of monetization. The estimates obtained are highly explanatory in the regressions for the observed coefficients of energy consumption.

Then we constructed regressions for the obtained variables of the shadow economy size for the developed samples of the world economies considered over the period of 2003-2006. Our results indicate that the hypothesis about the positive correlation between energy prices and the shadow economy size is confirmed in both cross country and panel data (i.e. in dynamics). The cross country model explaining differences economies includes the regulatory quality index as yet another regressor, apart from the real energy price. Both variables are significant and have the expected signs.

In order to analyze the endogeneity problem of the institutional index along with the ordinary least squares method we employed the model of two-stage estimation with instrumenting this index by the variable of infant mortality rate. Both methods applied give very similar results. Thus, we draw a conclusion that in those economies where the level of the real energy price was higher, the level of shadow economy was higher, under otherwise equal conditions. This can be explained by that the firms tend to compensate for higher costs by additional savings on tax and social payments, which determines their higher degree of income concealment.

Results of the panel model application for the growth rates of indices in the period of 2004-2006 provide evidence that an increase in relative energy prices resulted in the increased size of the shadow economy. This specification, along with the regressor of real price increment, includes a change in the interactive term that is the multiplication of tax burden and the regulatory quality index. The result shows that the growth of tax burden led to an increase in the shadow economy size with worsening regulatory quality, but the growth of tax revenues decreased the shadow economy size if the regulatory quality was improved. This corresponds well to our representations established already also at the stage of estimating the shadow economy size. The inflation level has also shown itself as a significant factor: more intense growth of the average level of prices corresponded to higher growth of the shadow economy size. Thus, our hypothesis that the increase in relative energy prices resulted in the increased size of the shadow economy was confirmed.

Our conclusions are also supported by other results that are discussed in the report. We tested the alternative data obtained within the approach based on the application of the DYMIMIC model (Schneider, 2004), though they are given for an earlier period of 2000-2003. In both cases, the empirical results turned out to be very similar.

Both systems of estimation (Table 1 and Table 7) have a common year, 2003, which allows a comparison of the effect of two estimates for the shadow economy: those obtained using the DYMIMIC model (Table 1, column 4) and our variables developed based on the analysis of money demand (Table 7, column 2). As expected, the elasticity of the effect of the shadow economy size on the index of the observed energy consumption is higher when our estimates are used than in the case of DYMIMIC estimations: approximately 0.77 against approximately 0.39, i.e. almost twice. It is natural to attribute this difference to distinctions between the real and observed change in energy consumption, at least partially. The point is that the first method involves a comparison of energy use and GDP, i.e. in fact the analysis of energy consumption, as one of the indicators of changes in the shadow economy size. Hence, it may take real changes in energy consumption for changes in the shadow economy size overestimating the amplitude of its fluctuations.

G. Appendix

Table A1

Summarizing variables of shadow economy size calculated using the modified method of demand for money (***sm03, sm04, sm05, sm06***) and DYMIMIC approach (*ss00, ss02, ss03*)

1. Former socialist economies

. summarize *sm03 sm04 sm05 sm06 ss00 ss02 ss03* if dfos==1

Variable	Obs	Mean	Std. Dev.	Min	Max
sm03	20	.3267711	.0592532	.246134	.480375
sm04	18	.3262653	.0590983	.246191	.450854
sm05	20	.352597	.0633476	.260173	.477032
sm06	19	.3631267	.0708329	.265505	.50994
ss00	26	.3631538	.1298715	.131	.673
ss02	26	.3732692	.1299128	.144	.676
ss03	26	.3834231	.1296988	.156	.68

2. CIS economies

. summarize *sm00 sm03 sm04 sm05 sm06 ss00 ss02 ss03* if dcis==1

Variable	Obs	Mean	Std. Dev.	Min	Max
sm03	6	.3675915	.0269328	.340331	.417828
sm04	4	.3970925	.03866	.36403	.450854
sm05	7	.4172	.0339482	.378955	.477032
sm06	8	.4292706	.0388598	.385469	.50994
ss00	10	.4828	.0969832	.341	.673
ss02	10	.4943	.0939823	.357	.676
ss03	10	.5052	.0905794	.372	.68

3. EE and Baltic Economies

. summarize *sm03 sm04 sm05 sm06 ss00 ss02 ss03* if deee==1

Variable	Obs	Mean	Std. Dev.	Min	Max
sm03	13	.3077095	.0634767	.246134	.480375
sm04	13	.3034576	.048208	.246191	.404666
sm05	12	.3142065	.0450839	.260173	.413951
sm06	11	.315022	.0439157	.265505	.407717
ss00	14	.3090714	.0656945	.189	.399
ss02	14	.3177857	.0671201	.193	.407
ss03	14	.3272857	.068375	.201	.413

4. OECD economies (without new members)

. summarize *sm03 sm04 sm05 sm06 ss00 ss02 ss03* if doec==1

Variable	Obs	Mean	Std. Dev.	Min	Max

sm03	23	.2113346	.0358905	.160474	.275698
sm04	23	.2015181	.0433578	.138833	.275229
sm05	23	.2045492	.0498576	.131651	.285215
sm06	22	.2124465	.0559941	.139914	.343774
ss00	24	.1840833	.0689883	.086	.321
ss02	24	.1851667	.0707572	.087	.332
ss03	24	.1826667	.0731001	.084	.343

Table A2

Shares of shadow economy in GDP by the world economies (modified method of demand for money, variable *sm*)

	2003	2004	2005	2006
Albania	48,0	40,5		
Algeria	39,4	41,6	47,7	45,8
Argentina	34,8	37,6	34,0	0,0
Armenia	34,0	36,4	37,9	38,5
Australia	18,8	17,6	17,9	18,4
Austria	19,7	18,7	19,1	19,7
Bangladesh	34,5	36,3		
Belarus	41,8	45,1	47,7	51,0
Belgium	19,8	18,6	19,0	20,0
Benin	35,0	37,5	39,8	39,3
Bolivia	33,9	36,7	42,8	43,3
Bosnia and Herzegovina	38,7	38,4	41,4	40,8
Bulgaria	32,1	32,8	36,4	36,6
Cameroon	31,4	32,2	34,0	
Canada	23,0	22,1	22,6	23,1
Chile	24,8	24,1	24,1	24,0
China	33,0	33,9	36,1	
Colombia	36,7	37,7	40,6	38,9
Congo, Rep.	35,7	32,2		
Costa Rica				30,7
Croatia	30,8	31,1	33,2	34,8
Cyprus	24,1	23,7	24,0	23,6
Czech Republic	26,7	27,4	28,2	29,1
Denmark	16,0	13,9	13,2	14,5
Dominican Republic			40,7	39,1
Egypt, Arab Rep.	31,5	32,0	33,7	35,4
El Salvador	33,6	34,5	37,2	38,6
Estonia	27,1	26,3	27,5	27,1
Finland	18,6	17,4	17,3	18,4
France	21,8	20,6	21,3	21,9
Georgia	35,0		39,4	39,1
Germany	24,5	24,3	24,7	25,1
Ghana	32,9	35,4		

Greece	26,6	26,2	28,4	28,7
Guatemala	36,3	37,7	40,2	40,6
Honduras	37,3	39,0	41,8	43,9
Hungary	25,4	25,2	27,1	27,3
Iceland	17,3	15,3	14,0	15,0
India	31,3	32,0	33,2	33,4
Indonesia	36,6	37,5		
Iran, Islamic Rep.	32,7	33,9	37,6	37,7
Ireland	20,0	18,4	18,2	17,9
Israel	24,6	24,1	24,8	24,8
Italy	25,5	26,1	28,5	30,4
Ivory Coast	41,5	45,2	49,4	48,2
Jamaica	38,7	39,8	43,7	43,8
Jordan	29,1	28,5	28,8	28,8
Kazakhstan	37,1	39,9	44,1	42,8
Kenya	38,7	41,2	45,4	
Korea, Rep.	27,6	27,5	27,9	
Kuwait	31,1	31,8	33,5	
Kyrgyz Republic				44,8
Latvia	28,6	29,0	30,3	30,4
Lebanon	33,9	33,9	34,0	0,0
Lithuania	28,2	27,9	29,8	30,4
Luxembourg	17,7	16,1	15,9	18,0
Malaysia	28,4	32,2	34,0	34,2
Malta	19,7	19,3	19,3	19,3
Moldova	36,3	37,5	40,2	41,5
Morocco	31,8	31,8	34,9	35,8
Namibia	29,9	32,2		
Nepal		35,2	38,6	37,3
Netherlands	19,9	18,6	18,3	18,8
New Zealand	16,1	14,3	13,7	14,0
Nicaragua	35,3	39,1	40,5	42,4
Norway	17,0	14,7	14,4	14,8
Pakistan	35,2	36,9	39,0	38,8
Paraguay			41,4	
Peru	34,7	36,5	40,3	34,2
Philippines	34,6	36,3	37,3	38,0
Poland	28,1	29,4	31,1	32,1
Portugal	22,7	22,6	23,6	25,3
Romania	32,5	33,3	35,6	
Russian Federation			43,0	43,6
Singapore	23,6	23,0	23,3	
Slovak Republic	29,1	28,7	30,6	31,4
Slovenia	24,6	24,6	26,0	26,6
South Africa	31,1	30,7	31,5	31,0
Spain	25,7	26,0	27,2	27,7

Sri Lanka	31,2	32,2	33,6	33,6
Sweden	19,9	18,6	18,8	19,0
Switzerland	24,3	23,7	24,1	
Tanzania	31,4	32,2		
Thailand			33,0	34,2
Togo			43,5	
Trinidad and Tobago	30,3	33,0	35,6	
Tunisia			31,6	30,8
Turkey				34,4
Ukraine	36,4		39,7	42,1
United Kingdom	17,9	16,7	16,9	16,7
United States	25,7	25,7	25,7	25,7
Uruguay	27,5	28,8	30,1	30,4
Venezuela, RB	37,6	40,7	46,7	
Zambia	35,9	37,7	40,2	40,7

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